

symbol S_i respectively; and

inversion means sequentially inverting said transfer matrices $H(f_j)$ and supplying the precompensation means with the inverted matrices $H^{-1}(f_j)$, the precompensation means sequentially calculates the products $H^{-1}(f_j) * S(f_j)$.

4. (Amended) A digital subscriber line transmission system comprising a plurality of line termination modems transmitting discrete multitone symbols S_i to corresponding network termination modems over n transmission channels, comprising:

a far-end crosstalk canceling circuit according to claim 1, canceling far-end crosstalk at the network termination side of said system; and

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a line termination far-end crosstalk canceling circuit canceling far-end crosstalk at the line termination side of said system by estimating the inverse of the transfer matrix H^{-1}_{up} of the plurality of the transmission channels in the upstream direction, said line termination far-end crosstalk canceling circuit supplying the storing means of said far-end crosstalk canceling circuit with $H = H^{-1}_{up}$.

5. (Amended) A digital subscriber line transmission system comprising a plurality of line termination modems transmitting discrete multitone symbols S_i to corresponding network termination modems over n transmission channels, comprising:

a far-end crosstalk canceling circuit according to claim 3 canceling far-end crosstalk at the network termination side of said system; and

a line termination far-end crosstalk canceling circuit canceling far-end crosstalk at the line termination side of said system by estimating the inverse of the transfer matrices $H^{-1}_{up}(f_j)$ of the plurality of transmission channels in the upstream direction at tone f_j , said line termination far-end crosstalk canceling circuit supplying the storing means of said far-end crosstalk canceling circuit with $H(f_j) = H^{-1}_{up}(f_j)$.

11. (New) The far-end crosstalk canceling circuit according to claim 2 wherein said storing means is organized in planes.

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12. (New) A far-end crosstalk canceling circuit for a data transmission system

comprising a precompensation circuit multiplying, before transmission, a vector $S = (S_i)$, $i = 1$ to n , by a precompensation matrix such that the matrix product H^*M is diagonal, H being a transfer matrix of the plurality of transmission channels defined by $R = H^*S$, where $R = (R_i)$, $i = 1$ to n , is the vector of the digital transmission symbols R_i respectively received by the modems.

13. (New) The far-end crosstalk canceling circuit of claim 12, further comprising:
a storage circuit storing said transfer matrix;
an inversion circuit inverting said transfer matrix and providing the precompensation circuit with the inverted matrix.

14. (New) The far-end crosstalk canceling circuit according to claim 13 wherein said storage circuit is organized in planes.

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15. (New) The far-end crosstalk canceling circuit of claim 12, further comprising:
a storage circuit storing transfer matrices of the plurality of transmission channels at tones being defined by $R(f_j) = H(f_j)^* S(f_j)$, where $R(f_j)$ is the vector $R(f_j) = (R_i(f_j))$ $i = 1$ to n and $S(f_j)$ is the vector $S(f_j) = (S_i(f_j))$, $i = 1$ to n , $R_i(f_j)$ and $S_i(f_j)$ being the components at tone f_j of the received discrete multitone symbol R_i and transmitted discrete multitone symbol S_i respectively; and
an inversion circuit sequentially inverting said transfer matrices $H(f_j)$ and supplying the precompensation circuit with the inverted matrices $H^{-1}(f_j)$, the precompensation circuit sequentially calculating the products $H^{-1}(f_j)^* S(f_j)$.

16. (New) A data transmission system comprising a plurality of line termination modems transmitting discrete multitone symbols S_i to corresponding network termination modems over n transmission channels, comprising:

a far-end crosstalk canceling circuit according to claim 12, canceling far-end crosstalk at the network termination side of said system; and

a line termination far-end crosstalk canceling circuit canceling far-end crosstalk at the line termination side of said system by estimating the inverse of the transfer matrix H

l_{up} of the plurality of the transmission channels in the upstream direction, said line termination far-end crosstalk canceling circuit supplying the storage circuit of said far-end crosstalk canceling circuit with $H = H^{-1}_{up}$.

17. (New) A data transmission system comprising a plurality of line termination modems transmitting discrete multitone symbols S_i to corresponding network termination modems over n transmission channels, comprising:

a far-end crosstalk canceling circuit according to claim 15 canceling far-end crosstalk at the network termination side of said system; and

a line termination far-end crosstalk canceling circuit canceling far-end crosstalk at the line termination side of said system by estimating the inverse of the transfer matrices $H^{-1}_{up}(f_j)$ of the plurality of transmission channels in the upstream direction at tone f_j , said line termination far-end crosstalk canceling circuit supplying the storage circuit of said far-end crosstalk canceling circuit with $H(f_j) = H^{-1}_{up}(f_j)$.

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18. (New) A data transmission system comprising a plurality of line termination modems transmitting discrete multitone symbols S_i to corresponding network termination modems over n transmission channels, further comprising a far-end crosstalk canceling circuit according to claim 15 canceling far-end crosstalk at the network termination side of said system, wherein:

each LT modem comprises an insertion circuit for inserting at predetermined times known symbols $P(i, f_j)$ as components at tone f_j of multitone symbols S_i ;

each network termination modem comprises a detection circuit for detecting at said predetermined times the components $R_k(f_j)$ and for deriving therefrom the coefficients $H_{ik}(f_j)$ of the transfer matrix $H(f_j)$;

each network termination modem further comprises a multiplexer for multiplexing data to be transmitted with said coefficients $H_{ik}(f_j)$; and

each line termination modem further comprises a demultiplexer for extracting from the received data said coefficients $H_{ik}(f_j)$.

19. (New) A far-end crosstalk canceling method for a data transmission system,

said data transmission system comprising a plurality of line termination modems transmitting discrete multitone symbols S_i to corresponding network termination modems over n transmission channels, wherein a vector $S = (S_i)$, $i = 1$ to n , is multiplied, before transmission, by a precompensation matrix M such that the matrix product H^*M is diagonal, H being a transfer matrix of the n transmission channels defined by $R = H^*S$, where $R = (R_i)$, $i = 1$ to n , is the vector of the discrete multitone symbols R_i respectively received by the modems.

20. (New) The far-end crosstalk canceling method of claim 19, further comprising:

inverting the transfer matrix H to produce the precompensation matrix M .

21. (New) The far-end crosstalk canceling method of claim 19, further comprising:

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for transfer matrices $H(f_j)$ of the n transmission channels at tones f_j , $H(f_j)$ being defined by $R(f_j) = H(f_j)^* S(f_j)$ where $R(f_j)$ is the vector $R(f_j) = (R_i(f_j))$, $i = 1$ to n , and $S(f_j)$ is the vector $S(f_j) = (S_i(f_j))$, $i = 1$ to n , $R_i(f_j)$ and $S_i(f_j)$ being the components at tone f_j of the received discrete multitone symbol R_i and transmitted discrete multitone symbol S_i respectively,

inverting the transfer matrices $H(f_j)$ to produce inverted matrices $H^{-1}(f_j)$, which are used as precompensating matrices at tones f_j .

22. (New) The far-end crosstalk canceling method of claim 21, further comprising:

inserting known symbols $P(i, f_j)$ at predetermined times as components at tone f_j of multitone symbols S_i ;

detecting the components $R_k(f_j)$ at said predetermined times, the coefficients $H_{ik}(f_j)$ of transfer matrix $H(f_j)$ being derived therefrom and multiplexed with the data to be transmitted; and

extracting said coefficients $H_{ik}(f_j)$ from the received data.

23. (New) A modem comprising a far-end crosstalk canceling circuit, said far-end crosstalk canceling circuit comprising a precompensation circuit multiplying, before transmission, a vector $S = (S_i)$, $i = 1$ to n , by a precompensation matrix such that the matrix product H^*M is diagonal, H being a transfer matrix of the plurality of transmission channels defined by $R = H^*S$, where $R = (R_i)$, $i = 1$ to n , is the vector of the digital transmission symbols R_i respectively received by the modems.

24. (New) The modem of claim 23, wherein the far-end crosstalk canceling circuit further comprises:

a storage circuit storing said transfer matrix;

an inversion circuit inverting said transfer matrix and providing the precompensation circuit with the inverted matrix.

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25. (New) The far-end crosstalk canceling circuit according to claim 24 wherein the storage circuit is organized in planes.

26. (New) The modem of claim 23, wherein the far-end crosstalk canceling circuit further comprises:

a storage circuit storing transfer matrices of the plurality of transmission channels at tones being defined by $R(f_j) = H(f_j)^* S(f_j)$, where $R(f_j)$ is the vector $R(f_j) = (R_i(f_j))$ $i = 1$ to n and $S(f_j)$ is the vector $S(f_j) = (S_i(f_j))$, $i = 1$ to n , $R_i(f_j)$ and $S_i(f_j)$ being the components at tone f_j of the received discrete multitone symbol R_i and transmitted discrete multitone symbol S_i respectively; and

an inversion circuit sequentially inverting said transfer matrices $H(f_j)$ and supplying the precompensation circuit with the inverted matrices $H^{-1}(f_j)$, the precompensation circuit sequentially calculating the products $H^{-1}(f_j)^* S(f_j)$.

27. (New) The far-end crosstalk canceling circuit according to claim 26 further comprising a counting circuit for performing frequency-time signal transformation.

28. (New) A data transmission system comprising a plurality of line transmission

modems transmitting discrete multitone symbols S_i to corresponding network termination modems over n transmission channels, including means for precompensating for far-end crosstalk.

29. (New) The data transmission system according to claim 28, wherein the means for precompensating for far-end crosstalk further comprise means for multiplying, before transmission, a vector $S = (S_i)$, $i = 1$ to n , by a precompensation matrix M such that the diagonal of the product equals H^*M , where H is a transfer matrix of the plurality of transmission channels defined by $R = H^*S$, where $R = (R_i)$, $i = 1$ to n , is the vector of the digital transmission symbols R_i respectively received by the modems.

30. (New) The data transmission system according to claim 29, further comprising means for estimating the inverse H_{up}^{-1} of the transfer matrix H_{up} of the n transmission channels.

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31. (New) The data transmission system according to claim 30, further comprising means for storing H_{up}^{-1} .

32. (New) The data transmission system according to claim 29, further comprising means for storing transfer matrices of the plurality of transmission channels at tones being defined by $R(f_j) = H(f_j)^* S(f_j)$, where $R(f_j)$ is the vector $R(f_j) = (R_i(f_j))$ $i = 1$ to n and $S(f_j)$ is the vector $S(f_j) = (S_i(f_j))$, $i = 1$ to n , $R_i(f_j)$ and $S_i(f_j)$ being the components at tone f_j of the received discrete multitone symbol and transmitted discrete multitone symbol respectively.

33. (New) The data transmission system according to claim 32, further comprising means for sequentially inverting said transfer matrices $H(f_j)$ and supplying said means for precompensating with the inverted matrices $H^{-1}(f_j)$ for sequential calculation of the products $H^{-1}(f_j)^* S(f_j)$.

34. (New) The data transmission system of claim 33 further comprising: